


Tanta University Faculty Of Engineering

Electrical Power and Machines Department

***1st Year (Electrical) 2012/2013** (2nd Term)*

***Electrical Circuits (2)** (EPM1203)*

Sheet (2)

Response of RLC circuits

1)The initial voltage on the 0.1 µF capacitor in the circuit shown in the fig.1 is 24 V. The initial current in the inductor is zero. The voltage response for t ≥ 0

$$v(t) = -8e^{-250t} + 32e^{-1000t} \text{ V} \quad , t \geq 0.$$

a) Determine the numerical values of R, L, α, and ωo.
b) Calculate i_R (t), i_l (t), and i_C (t) for t ≥ 0+

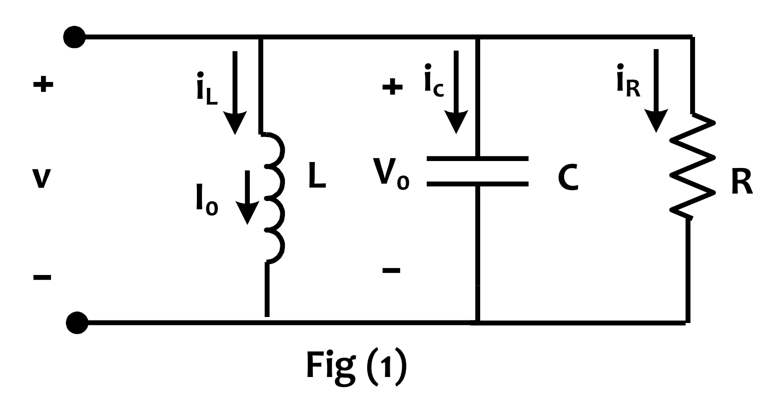


Fig (1)

2)The circuit elements in the circuit in the fig.1 are R=200Ω, C=0.2µF, and L=50mH. The initial inductor current is -45 mA, and the initial capacitor voltage is 15V.
a) Calculate the initial current in each branch of the circuit. **Find:**
b) v(t) for t ≥ 0.
c) i_l(t) for t ≥ 0.

3)The resistance in fig.1is increased to 312.5 Ω. **Find** the expression for v (t) for t ≥ 0.

4)The resistance in fig.1 is increased to 250 Ω. **Find** the expression for v(t) for t ≥ 0.

5)The natural response for the circuit shown in fig.1 is shown to be

$$v(t) = 3(e^{-100t} + e^{-900t}) \text{ V} \quad , t \geq 0.$$

If L = (40/9) H and C=2.5µF, **Find:** $i_l(0^+)$ in mA.

6)The natural voltage response of the circuit in fig.1is

$$v(t)= 100e^{-20000t}[\cos(15000t)-2\sin(15000t)] \text{ V} \qquad , t\geq 0.$$

When the capacitor is 0.04 μF. **Find: (a)** L; **(b)** R; **(c)** v_0; **(d)** i_0; **and (e)** $i_l(t)$.

7)The initial value of the voltage vin the circuit in fig.1 is 15 V, and the initial value of the capacitor current, $i_c(0^+)$, is 45 mA.The expression for the capacitor current is known to be

$$i_c(t) = A1e^{-200t}+A2e^{-800t}, \quad \text{for } t \geq 0^+$$

When R is 250 Ω. **Find:**

a) The value of α, ωo, L, C, A1, and A2

b) The expression for v(t), for $t \geq 0^+$

c) **The** expression for $i_R(t)$, for $t \geq 0^+$,

d) The expression for $i_l(t)$, for $t \geq 0$.

8)The voltage response for the circuit in fig.1. is known to be

$$v(t)=D1e^{-500t}+D2e^{-500t}, t \geq 0$$

The initial current in the inductor (i_0) is -10 mA, and the initial voltage on the capacitor (v_0) is 8 V. The inductor has an inductance of 4 H. **Find:**

a) The value of R, C, D1, and D2.

b) $i_c(t)$ for $t \geq 0^+$

9)The two switches in the circuit seen in fig.2. operate synchronously. When switch 1 is in position a, switch 2 is in position d. when switch 1 moves to position b, switch 2 moves to position c. switch 1 has been in position a for a long time At t = 0, the switches move to their alternate positions. **Find** $v_0(t)$ for $t \geq 0$.

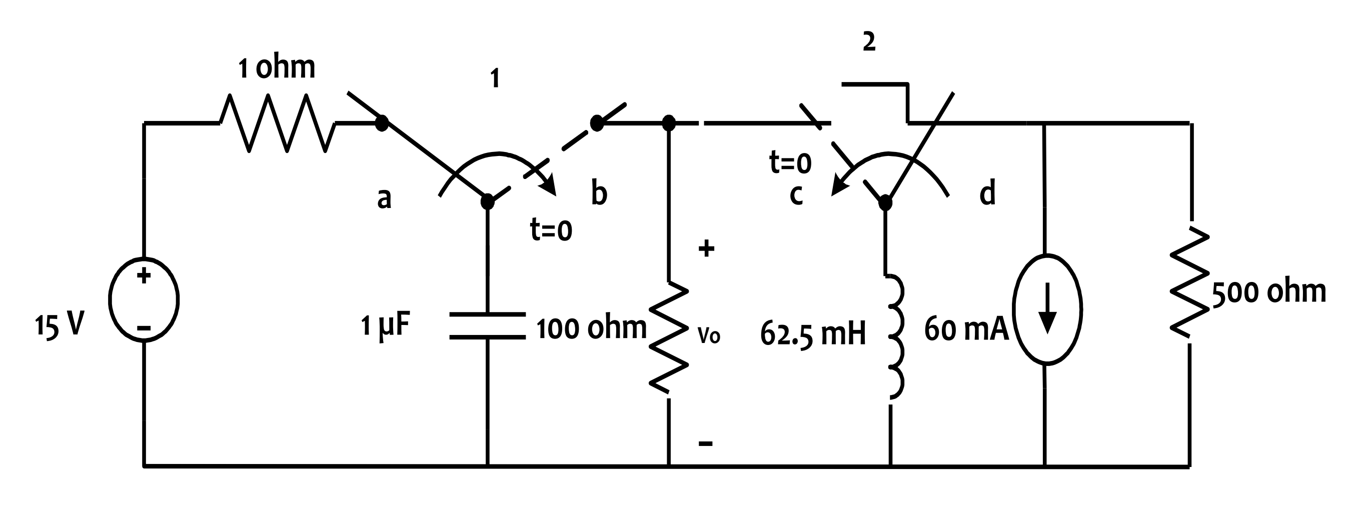


Fig (2)

10) The resistor in the circuit of fig.2 is increased from 100 Ω to 200Ω. **Find** v_0(t) for t > 0.

11) The resistor in the circuit of fig.2 is increased from 100Ω to125Ω. **Find** v_0(t) for t ≥ 0

12) The switch in the circuit in fig.3 has been open a long time before closing at t = 0. **Find** i_l(t), for t ≥ 0.

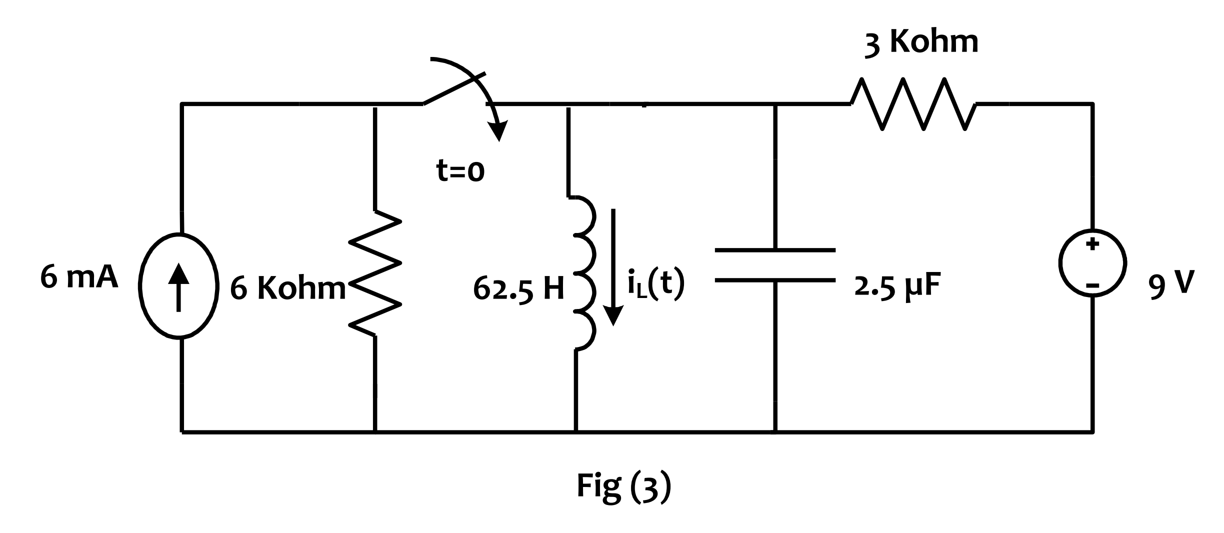


Fig (3)

13) Assume that at the instant the 60 mA dc current source is applied to the circuit in fig.4 the initial current in the 50 mH inductor is -45mA, and the initial voltage on the capacitor is 15 V (positive at the upper terminal). **Find** the expression for i_l(t) for t ≥ 0 if R equals 200 Ω

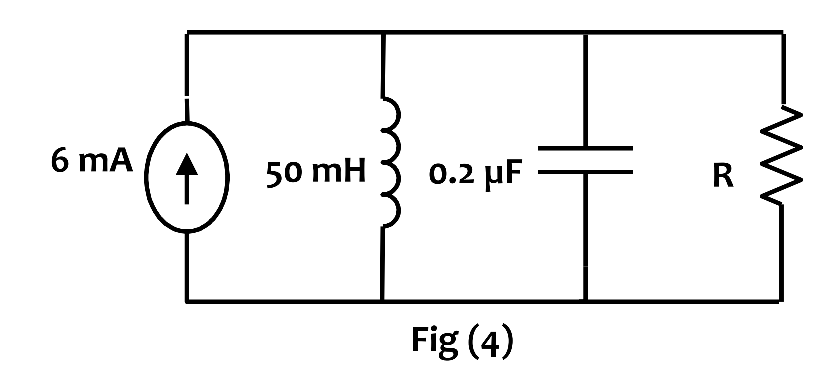


Fig (4)

14) The resistance in the circuit in fig.4 is increased to 312.5 Ω. **Find** i_l (t) for t ≥ 0.

15) The resistance in the circuit in fig.4 is changed to 250 Ω. **Find** i_l (t) for t ≥ 0.

16) The switch in the circuit in fig.5 has been open a long time before closing at t = 0.
Find: a) v_0(t) for t ≥ 0^+. B) i_l(t) for t ≥ 0.

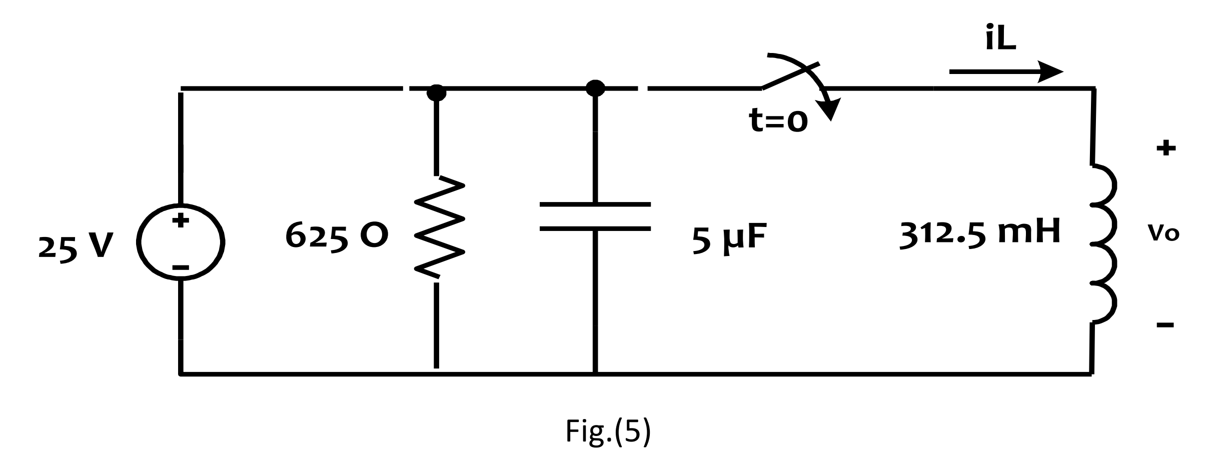


Fig.(5)

17) The switch in the circuit in fig.6 has been in position a for a long time. At t = 0, the switch moves instantaneously to position b.

a) **What is** the initial value or v_a?
b) **What is** the initial value of dv_a/dt?
c) **What is** the numerical expression for $v_a(t)$ for $t \geq 0$?

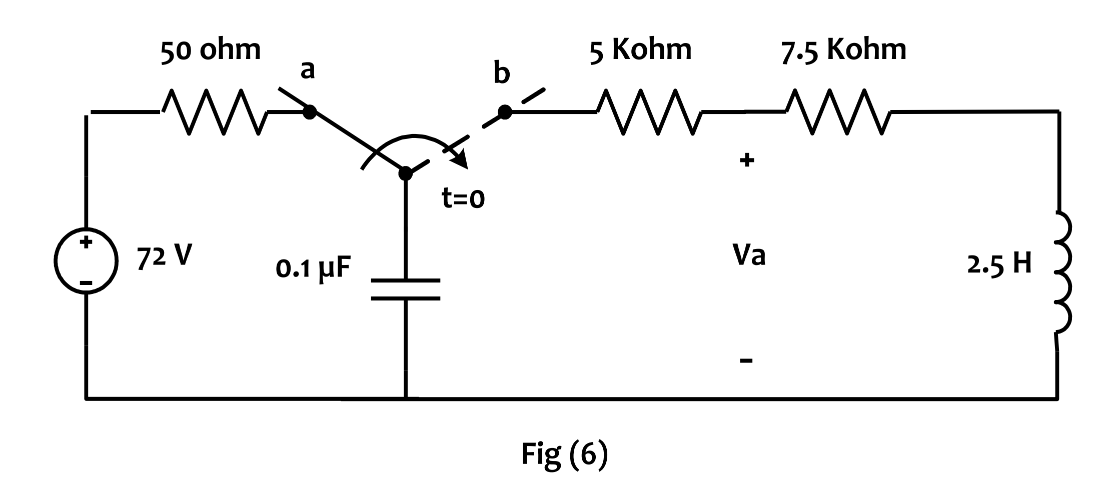


Fig (6)

18) The make-before-break switch in the circuit shown in fig.7 has been in position a for a long time. At t = 0, the switch is moved instantaneously to position b. **Find** $i_l(t)$ for $t \geq 0$.

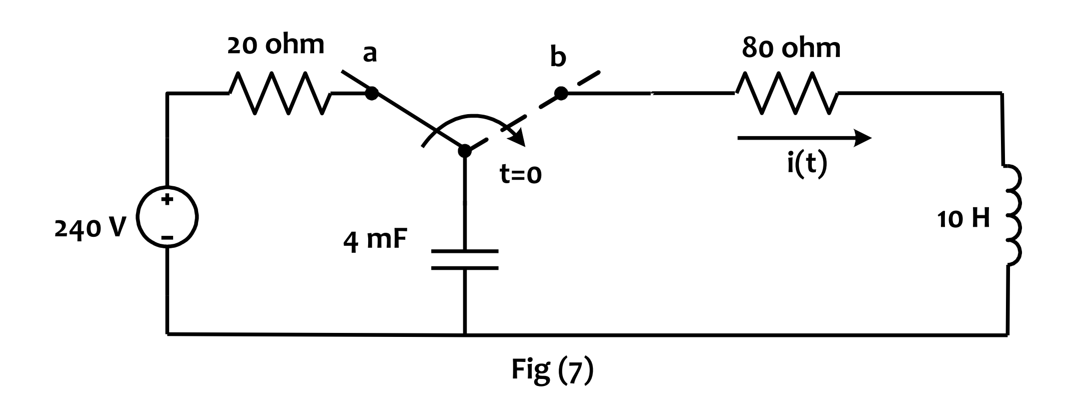


Fig (7)